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A Technical Comparison of an 1807, a 1916, and a 1968 Oboe and Related Reedmaking and Performance Problems.

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A TECHNICAL COMPARISON OF AN 1807, A 1916, AND A 1968 OBOE

AND

RELATED REEDMAKING AND PERFORMANCE PROBLEMS

A Dissertation

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ABSTRACT

The purpose of this monograph was to investigate and compare the dimensions, reed-making techniques, and performance problems of three oboes, each representing an era in the development of the oboe.

The instruments in the project were an 1807 Button and Purdy "two-keyed" oboe, a 1916 Conn "military system" oboe, and a 1968 Gordet "full-conservatory system" oboe. The 1807 and 1916 oboes are the property of the Arne B. Larson Music Collection currently housed on the campus of the University of South Dakota, Vermillion, South Dakota. The 1968 oboe is the personal property of, and used professionally by, the author.

The ultimate aim of the investigation and comparison was to give credance to the idea that instruments and instrumentalists of earlier centuries were capable of producing music that, although different in timbre and interpretation, would be acceptable to the music listener of today. Before performance characteristics could be compared, however, a familiarization with the fingerings and reed-making techniques of the 1807 and 1916 oboes was necessary. Baroque fingerings were required of the 1807 oboe and familiarity with the "military system" and the

peculiar thumb-plate mechanism of the 1916 oboe were of primary importance in this aspect of the project.

Reed preparation for the two older instruments was experimental in nature. No prior knowledge of early reed-making procedure was used, except some information gained by a brief association of the author with oboists from the Stockholm Symphony Orchestra, who played contemporary "full conservatory" oboes, but used reeds commonly prepared for use with the 1916 oboe. Many dimensions and scrape designs were experimentally applied to the reeds with the eventual goal being a balance between reed style and instrument type to provide a pleasing sound and performance quality.

Tape recordings were made of each instrument as it played representative scales and two versions of excerpts from Karl Stamitz' Concerto for Oboe in Bb. The first version of the Concerto displays the initial contact with the instruments (except for the 1968 oboe); the second is representative of several hours of practice familiarizing the author with reed adjustment, fingerings and embouchures required to produce a recorded example that would indicate that with many more hours of practice, as expended by a professional, the sound and technique of the older instruments would produce an esthetically pleasing performance to the listener of today.

The technical dimension comparison of the three oboes was undertaken to provide statistics relating to construction of the instruments that would provide insight into performance characteristics and eventual reconstruction of the instruments if desired.

Conclusions from the project are two-fold: 1) Much work is needed in documentation and research involving reed preparation and mechanical construction of older instruments; and, 2) the intuitions of a sensitive musician and the adaptability of the human musculature involved would, regardless of the prevalent contemporary performance techniques, aid in the eventual acquisition of a timbre and technique satisfactory to the discriminating listener.

I. INTRODUCTION

The primary purpose of this research project is to document the process of objective and subjective observation and experience in understanding the mechanical aspects, fingering techniques, reed construction, and performance characteristics of two oboes, each dating from a different century and of differing design.

The instruments involved in this project are an 1807 two-keyed oboe and a 1916 oboe with the Triebert Systeme 4 or "military" fingering. The instruments were compared with a 1968 oboe equipped with the French full-conservatory fingering system. (See Plate 1)

Both older instruments were located in the Arne B. Larson Music Collection at the University of South Dakota, Vermillion, South Dakota. The 1968 oboe is the property of this writer.

The 1807 oboe

The oldest instrument, an 1807 Button and Purdy two-keyed oboe, made of boxwood, was manufactured in London, England. The firm of Button and Purdy later became Purdy and Whittaker, and eventually Whittaker and

Plate I. Oboes Used in Project

Co.[1] The basic design of the oboe was prevalent in the 18th century and persisted into the first quarter of the 19th century. It exhibits a pirouette at the upper end of the instrument. The pirouette is ornamental, persisting from the pre-Baroque period when the player pressed his lips against it for support while blowing. The bulbous area below the pirouette is the bore expansion bulb, also referred to as the baluster. The bulb is also ornamental no longer functioning as the enclosed area in which the pre-Baroque free blowing reed was housed. The fingering system for this oboe is the same as that of the transverse flute of the 18th century. The two keys were made of brass that was hammered and filed into shape. The swallow-tail c key consists of two sections, the touchpiece and the key. These sections are connected by means of a hinge that closes the key as the touchpiece is depressed. Figure 1 depicts this action.[2]

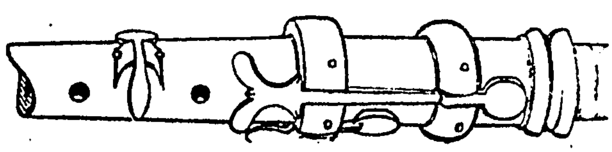

Figure 1. 1807 oboe,
swallowtail key action

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[1]Lyndesay G. Langwill, An Index of Musical Wind-Instrument Makers. (Edinburgh, Scotland: Lyndesay G. Langwill, 1960).

[2]Baines, Musical Instruments Through the Ages. (Baltimore: Pelican Books, 1963), p. 251.

The D#-Eb key, also pictured in the figure has the touchpiece and the key in one section, and the key opens as the touchpiece is depressed. Both keys are attached to the instrument by a brass axle or pin that is anchored laterally into raised wooden rings around the circumference of the instrument. The pads of the keys are cork, and are probably replacements of the originals. The springs were flat brass "leaf" springs mounted parallel under the touchpiece mechanism. The bell contains two vent-holes through which the low C speaks. The bell design is of an early type with a "lip" area at the lower end of the bell. A cross section of the bell is shown in Figure 2.

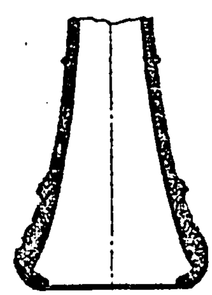

Figure 2. Bell Design[1]

The function of the bell "lip" was to prevent the fragile and thin edge of the bell from splitting under impact. Its effect on pitch and timbre is negligible.

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[1]Nicholas Bessaraboff, Ancient European Musical Instruments. (Cambridge: Harvard University Press, 1941) p. 119.

The tenon joints of the upper and lower sections were normally wrapped with silk string to secure a proper fit into the tenon socket. Later instruments used cork because of its durability and superior sealing characteristics.

The instrument was in playing condition. A crack in the bell extending approximately six centimeters vertically from the bell flare up was the only defect and did not affect its ability to be played.

The 1916 oboe

The 1916 oboe is made of ebonite, and has the brand of Conn stamped on the bell. The material ebonite is a form of hard rubber, also known as vulcanite, which results from vulcanizing rubber with a high percentage of sulphur and has existed since c. 1850.[1] The distinguishing feature of the instrument was the key system, known as the Triebert *Système 4*, or the "military" system. The system used a thumb-plate action dating from 1848 and attributed to Guillaume Triebert (1810-1848), a French manufacturer of oboes. Frederick Triebert, his son, was responsible for its manufacture. However, it is often referred to as *Système Charles Triebert*, another son of Guillaume, who was influential in the *Systeme's* adoption at the Paris

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[1]Alexander S. Craig, *Rubber Technology, A Basic Course*, (Edinburgh: Oliver and Boyd, 1963), p. 138.

Conservatory around 1850.[1] The thumb-plate action allows the player to obtain b, a, and c by using the thumb-plate and combinations of L1 and L2. The action may be used in addition to the previously existing fingering that employed a right hand side-key in combination with L1 and L2. The Triebert Systeme 4 was augmented later by A.M.R. Barret (1804-79) who added still another connection for the b^{b1} and c^2 by using R1 with L1 and L2. The Barret addition is important in the evolution of oboe key systems because it led to the Triebert Systeme 6 in which R1, R2, and R3 were used in combination with L1 and L2 to produce b^{b1} and c^2. The key system in use today is similar to Systeme 6 except that only R1 is used in combination with L1 and L2. The thumb-plate was also abolished. Figures 3a, b, and c illustrate the Action of Systeme 4, Barret's improvements, and the Conservatory system in use today. The Conservatory system is also known as the Gillet system after Georges Gillet (1854-1934), a famous performer and professor at the Paris Conservatory who aided in improving the Triebert Systeme 6. Figure 3a shows the mechanism employed on the 1916 Conn oboe.[2]

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[1]Philip Bate, The Oboe, An Outline of Its History and Development, (New York: Philosophical Library, 1956), pp. 60-65.

[2]Bate, The Oboe, pp. 64, 69.

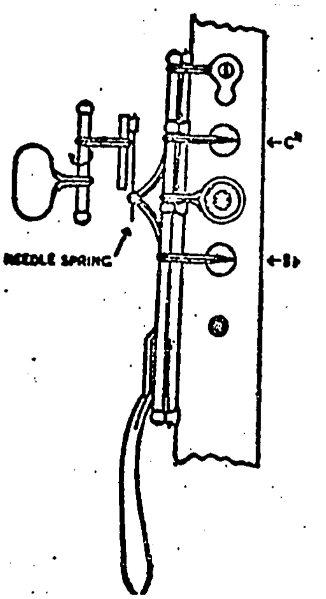

Figure 3a. Système 4 Action

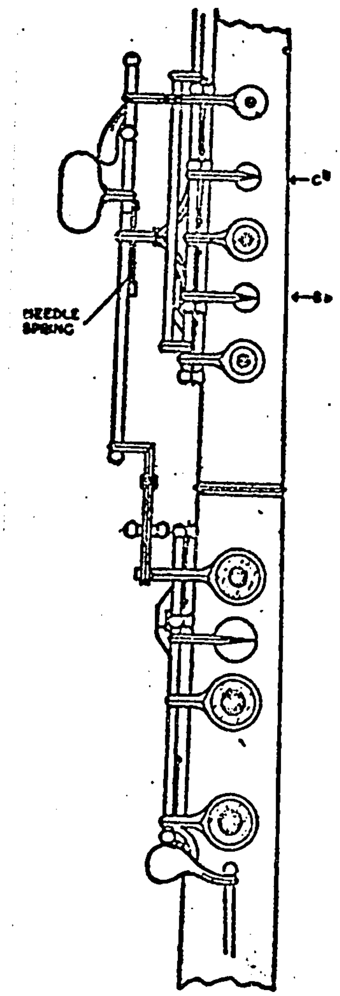

Figure 3b. Barret's Improvements on Système 4

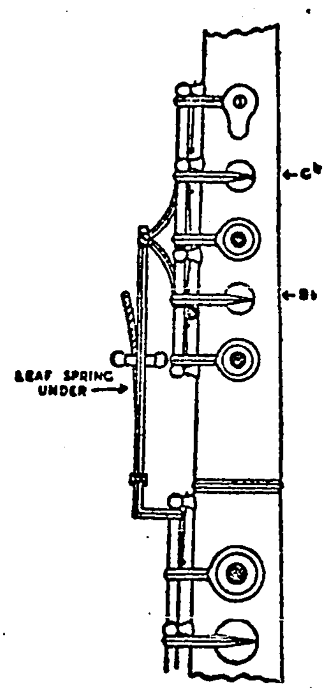

Figure 3c. Present Conservatory System

The 1916 oboe was slightly curved throughout its length; the curvature probably resulted from improper storage and exposure to heat which softened the ebonite slightly and allowed it to assume a curved shape. The curvature did not affect the pitch, timbre, or key alignment.

The 1968 oboe

The 1968 Gordet oboe is imported from Germany by Ben Storch of New York City. The factories produce the instruments under his specifications. The model discussed is a French full-conservatory system, made of grenadilla wood, stained black. The French, full-conservatory key system innovations are discussed below under Mechanism development.

Mechanism development

The mechanisms described above resulted from efforts to eliminate the cross fingerings (see Glossary) used for b^b and c on the older two-keyed instruments. The cross fingerings were "fuzzy" in timbre and generally flat in pitch. The octave keys, or "speaker" keys were the first additions to the two keyed oboe. Many two keyed oboes exist in Europe on which the octave key was a later addition. The octave key was an important advancement in oboe technique for two reasons: (1) The overblowing of all notes above e^{b2} required the player to pinch the blades of the reed together with his lips resulting in a sharpening of the pitch in the middle and upper registers; (2) reeds on instruments without octave keys were stiff and difficult to blow due to the scrape design required to permit overblowing with a minimum of pitch distortion. The addition of octave keys, one for the middle register eb^2-$g\#^2$, and one for the upper register a^2-c^3 allowed the player to achieve a more "open" timbre in these registers with less effort than before.

The 1807 oboe did not possess the two octave keys, but the 1916 oboe did have two independently operating keys that were manipulated individually. Modern instruments have each of the octave keys close automatically when the other is in use.

The low range of the 1916 oboe extended to small b natural. The b natural key was added to instruments c. 1800-1825. The b natural key existed as an extension into the bell on the older instruments such as the 1807 oboe. The vent-holes in the bells of these instruments, when covered, produced the b natural. However, subsequent acoustical changes in oboes found the b natural key as the last opening in the lower joint, leaving the bell free of keys until the addition of the low Bb key by Josef Sellner (1787-1843) around 1810.[1]

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[1]Bate, The Oboe, pp. 53-55.

The 1968 oboe features a third octave key for use on notes above d^3. The touchpiece of the third octave key is in the same plane as the touchpiece of the first octave key, and occupies approximately one-half of the latter's length. The speaker hole for the third octave is located on the right side of the instrument, approximately half the distance between the first and second octave keys. This third octave key is not common on most oboes in use today. A left-hand f key is located above and between the keys operating the low b flat and b natural keys. It is valuable in eliminating the constant use of the forked-f fingering required on most instruments, when f natural is approached or left by notes involving the R3 finger. The forked-f is "stuffy" in timbre and often produces third notes (see Glossary) in its manipulation. The range of the oboe extends to small b flat, which is located in the bell joint, and operated by the little finger of the left hand.

II. INVESTIGATION PROCEDURES

Mechanical aspects

The mechanical aspects studied involved the comparison of dimensions of the three instruments from key mechanism measurements and placement on the instrument to the placement of tone holes, their diameters, and the dimensions of the bore at the tone holes.

Reed preparation

The preparation of reeds for each of the three instruments required techniques different for each instrument. The modern oboe reed would not function satisfactorily on the 1807 and 1916 oboes. The lack of certain keys and the bore characteristics on the older instruments required reeds to be altered in dimensions and scrape design. Reeds were copied from reference sources and also prepared experimentally in the search for reeds acceptable for performance on the older instruments.

Instrument performance

The final experimental stage involved performance of a work available to performers contemporary with all these instruments. Timbres of the instruments varied because of differing bores, tone-hole dimensions, reed characteristics and embouchure (see Glossary) employed. Excerpts from the _Concerto for Oboe_ in Bb by Karl Stamitz were played on each of the three instruments. The excerpts were played and recorded twice with each of the two older instruments. The first recording demonstrated the performer's fundamental acquaintance with the fingering and timbre characteristics of the instruments. The second recording demonstrated the improvement in timbre, finger technique, and relative intonation after more familiarization with the instruments.

Objective purposes of the study considered the measurement comparisons, reed construction, and key-system technique. Subjective evaluations involved determination, by actual playing experience, whether instruments of differing key systems and historical backgrounds were capable of technical and esthetic satisfaction in actual performance.

The fact that the second recording of the excerpt proved to be superior in all esthetic considerations indicates that a degree of artistry could be obtained on the older instruments, if the performer were engaged with the instrument in full-time activity.

III. DIMENSION MEASUREMENT

The comparison of dimensions of the three instruments consisted of a detailed examination of all measureable parts of each of the three oboes. Dimension measurement was undertaken to become familiar with every mechanical aspect of the instruments and to devise a comparative chart of these measurements.

Tone-hole dimensions

The bore diameter of the instrument at each tone hole was obtained by measuring the depth of each tone hole and the diameter of the instrument at each tone hole. From this information, the thickness of one wall of the instrument was computed and then the diameter of the bore, or inside diameter of the instrument was computed. The complicated procedure was necessitated because of the lack of tools designed specifically for such measurements. The measurements were made to the closest 1/10 of a millimeter and were intended for relative comparison only. The distance of the center of the tone hole from the upper end of each joint was also measured to pinpoint its relative relationship on the instrument. Variations in bore dimensions of the instruments measured are also reflected by the differences in the relative placements of the tone holes.

Key mechanism dimensions

Measurements of the key mechanism included the distance of the key's anchor post (see Glossary) from the upper end of each joint. The positioning of the posts is in direct relationship to the ratio of the touchpiece length and the pad-arm length and the ease and efficiency of the operation of the key. Operating efficiency is also determined by the strength of the spring, and the placement of the spring on the axle that it manipulates.

Outside dimensions

The outside diameters of the instrument, the pirouette, baluster, bell design, and capital affect the balance of the instrument in the player's hands and the placement of keys. The 1807 oboe exhibited the baluster, capital, and pirouette as ornaments. The 1916 and 1968 oboes were constructed with only a replica of the pirouette and no baluster. The bell design of each instrument was important. The length of the bell and its flare affect the stability of notes in the middle and upper registers of the instrument, and consequently govern reed design and scrape style.

The overall lengths of the oboes were also compared to examine the lengthening process changing the oboe since the middle of the 18th century. Individual joint lengths were also measured.

Photographs

For clarity of description and measurement, each instrument, with the exception of the 1807 oboe, was photographed in three positions. The positions were the overall length, the front side of each section and the reverse side of each section. The reverse side was applicable to only the 1916 and 1968 oboes because they exhibited touchpiece mechanisms on that side of the instrument. The 1807 instrument did not possess keys on the back side and was not photographed from that position. (See Plates II, III, IV, V, VI).

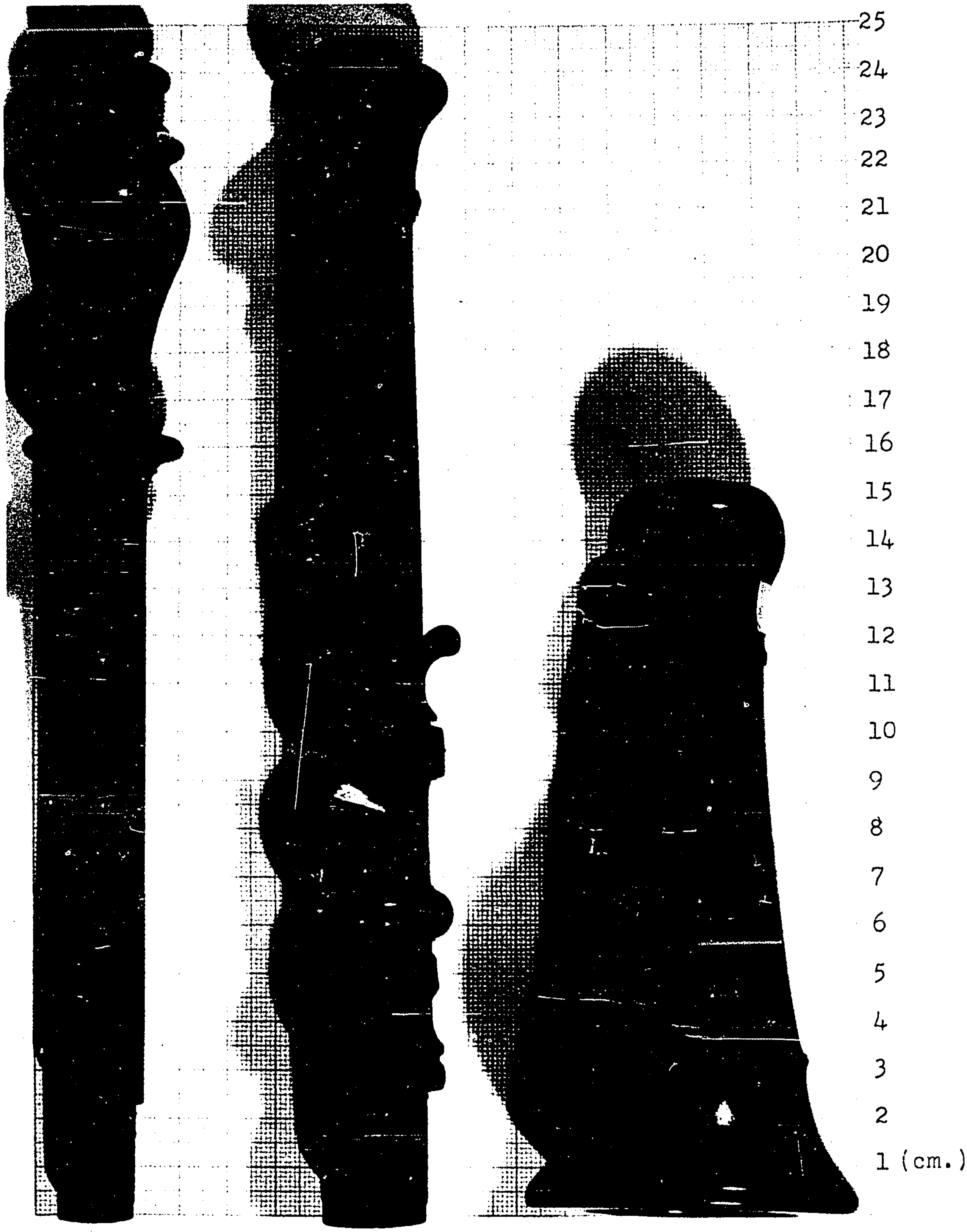

Plate II. 1807 Button and Purdy Oboe with upper, lower, and bell joints photographed from front only

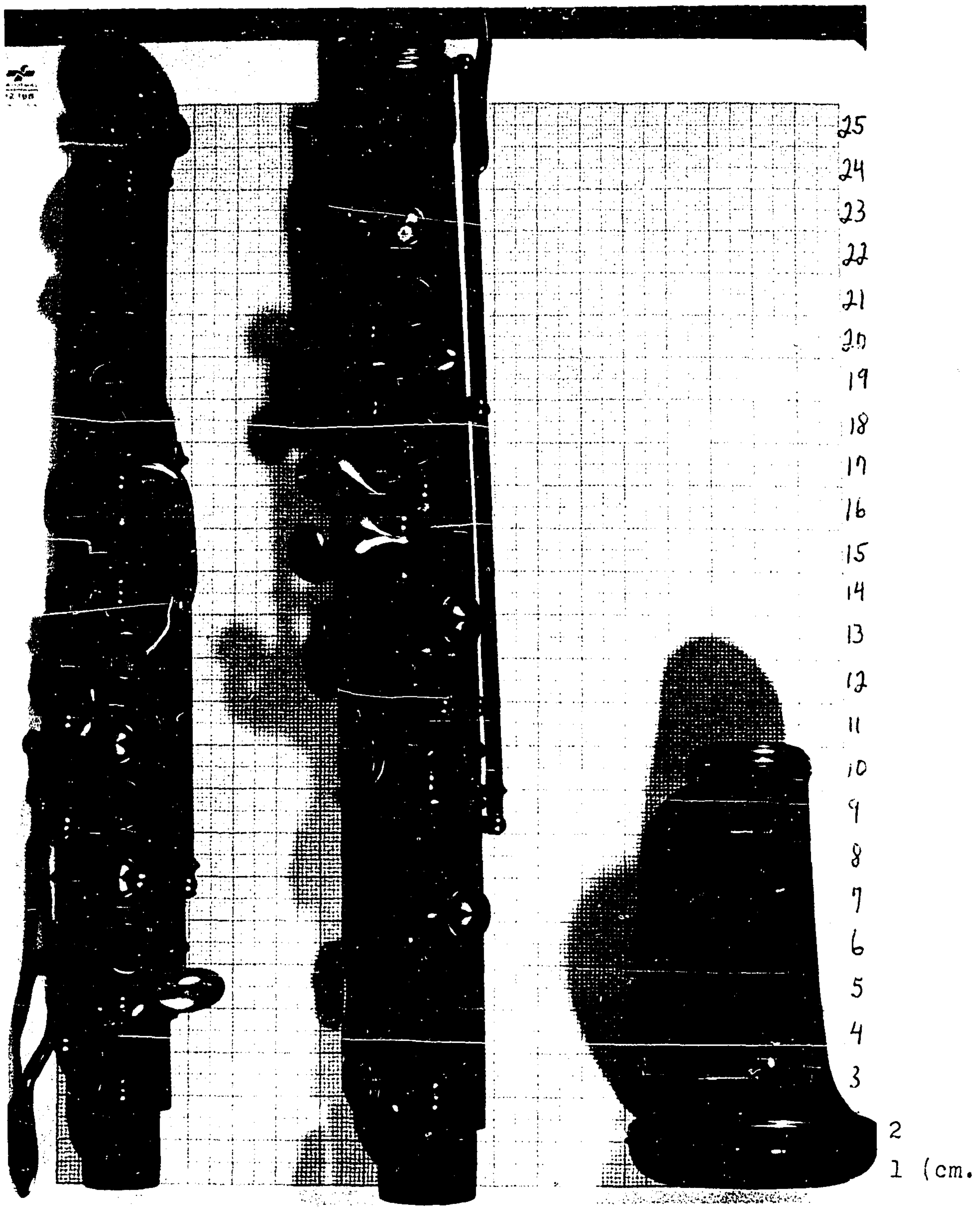

Plate III. 1916 Conn oboe with upper, lower, and bell sections photographed from the front.

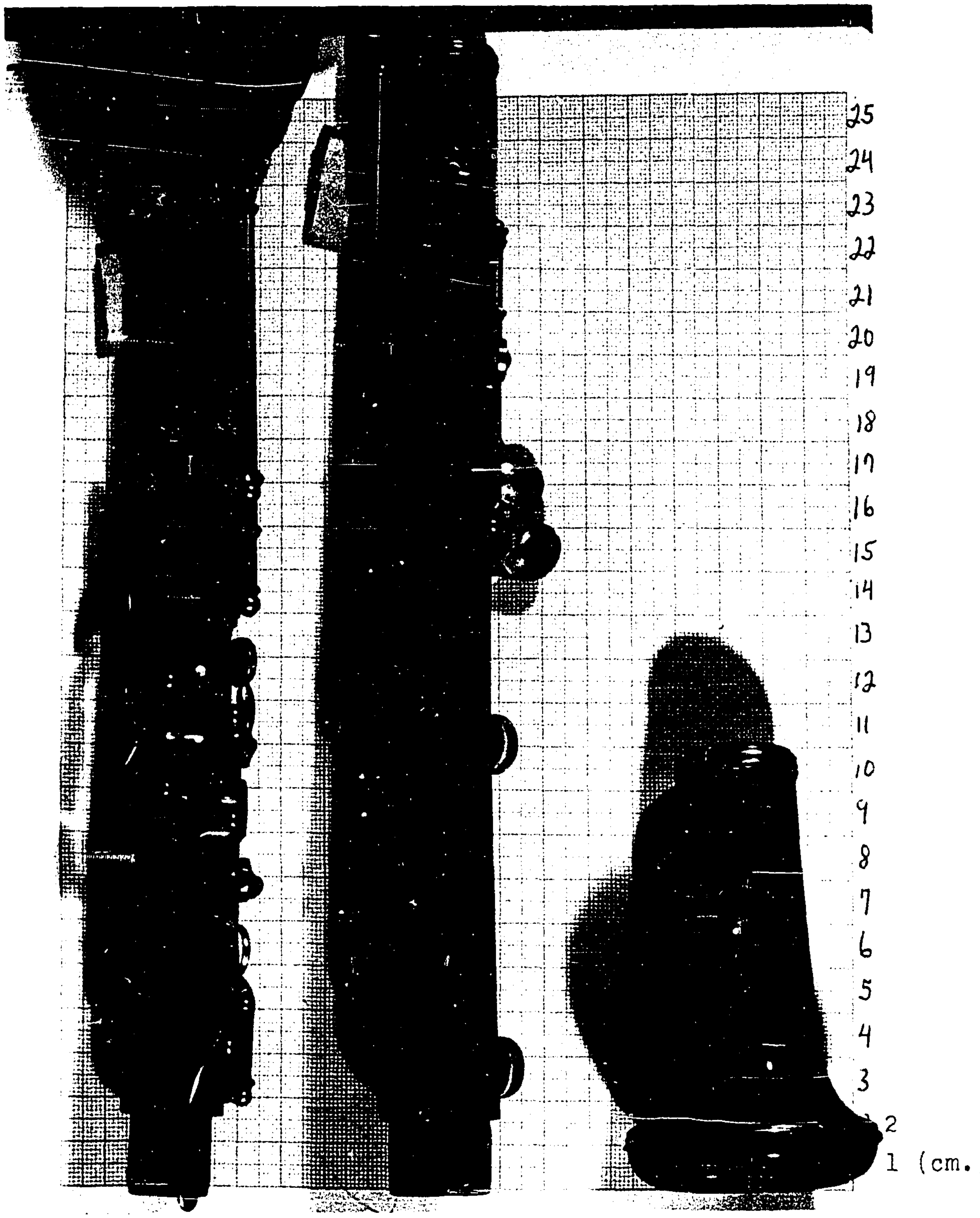

Plate IV. 1916 Conn oboe with upper, lower, and bell sections photographed from the rear.

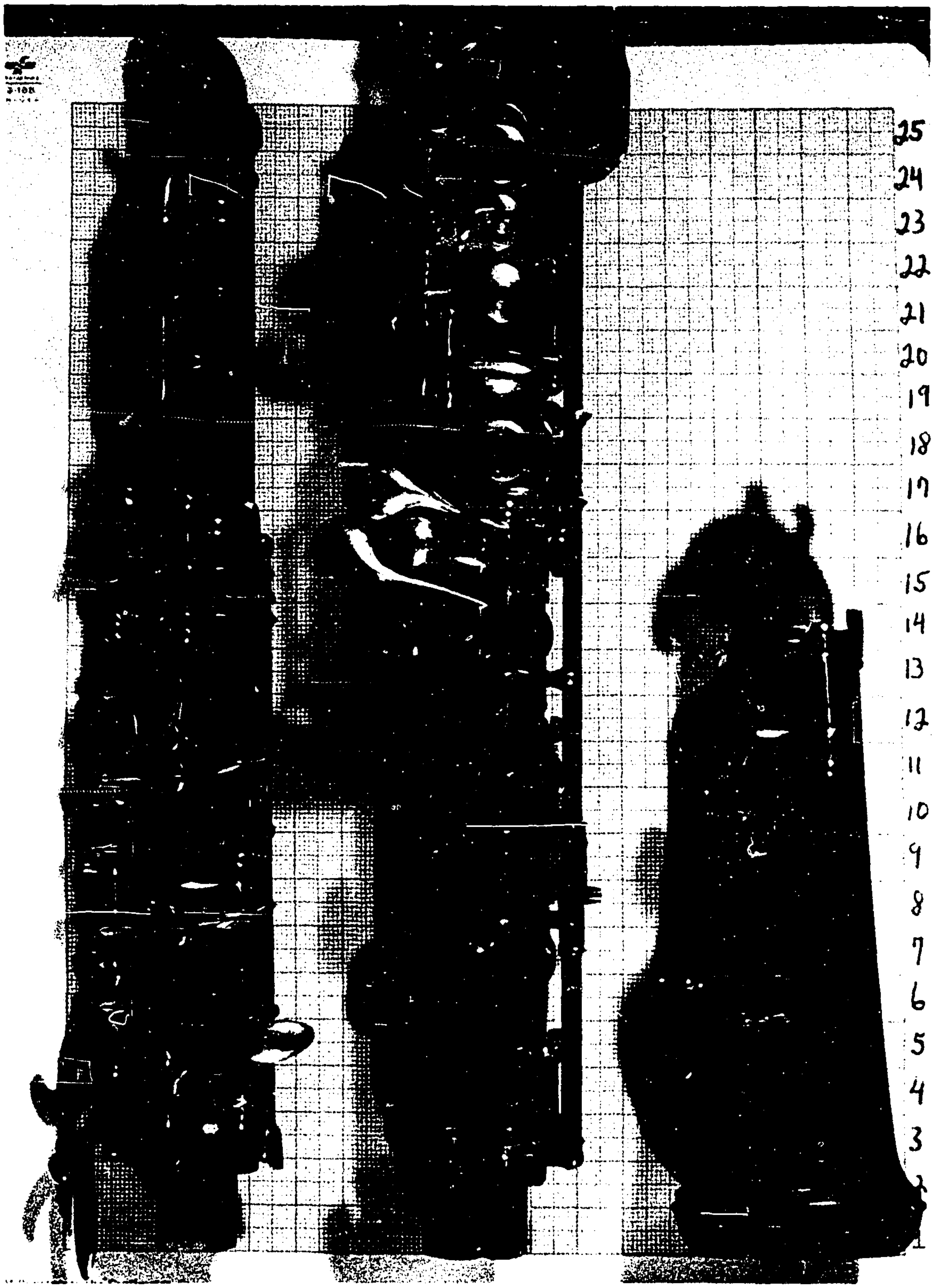

Plate V. 1968 Gordet oboe with upper, lower, and bell sections photographed from the front.

(cm.)

Plate VI. 1968 Gordet oboe with upper, lower, and bell sections photographed from the rear.

IV. REED PREPARATION PROCEDURES

The reeds prepared for each of the three oboes required differing scraping techniques and overall dimensions to insure pitch accuracy and consistent timbre characteristics.

The reed prepared for the 1807 oboe was of a scrape design no longer in general use in the United States; however, such a scrape style still exists in parts of Europe, mainly England and France. Since no reeds contemporary with the 1807 oboe were available, an experimental manufacturing process to determine the reed design for the instrument was undertaken.

To guide the experimental reed-making process, Mersenne[1] and MGG[2] were consulted. The article in MGG "Oboe Acoustics" contained the most detailed examples, and was consequently copied during the experiment. The Mersenne text was considered proportionally unreliable for imitation because of discrepancies in the drawings as

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[1]Marin Mersenne, Harmonie Universelle, Trans. by Roger E. Chapman (The Hague: M. Nijhoff, 1957), pp. 370-71.

[2]Wilhelm Stauder, "Oboe Acoustics", Musik in Geschichte und Gegenwart, Vol. 9, col. 172.

related to the text. The text states that the reed extends two inches beyond the instrument and that the instrument was twenty-four inches long. When the reed length was superimposed over the length of the illustration, twelve reed lengths were longer than the instrument. Figures 4a and b are the reproductions of the Mersenne and MGG drawings. The MGG example measures 5.45 cm, or approximately two inches, and corresponds to the Mersenne text description. The tip is 8 mm wide compared to the 11 mm tip as explained in the Mersenne text and translation.

If compared to a modern reed, these dimensions appear to be accurate. The mean standard pitch in Europe c. 1807 was A 422.5; a semitone lower than present day standards.[1] Tip width and reed length affect pitch. Oboists in the United States presently use a reed with a tip of 6-7 mm in width and 2 1/2 - 2 5/8 inches in total length. The reeds of the 1807 oboe would appear to be higher in pitch, but the ratio of tip width to reed length is critical in determining the pitch of the instrument. A 1 mm increase in tip width will necessitate the shortening of the reed by approximately three millimeters to equal the pitch of the reed using a one millimeter tip.

Eight reeds were prepared for the experiment, each featuring differing dimensions and scrape style. The

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[1]Alexander J. Ellis, The History of Musical Pitch (Amsterdam, Frits A. M. Knuf, 1963) from Journal of the Society of Arts, Article 26, March 5, 1880, p. 308.

Figure 4a. MGG Reed Representation

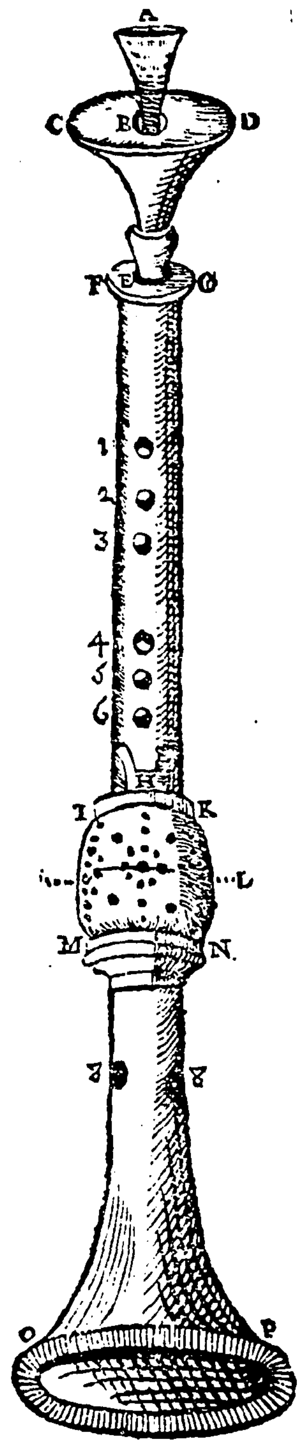

Figure 4b. Mersenne Oboe and Reed

specifications of the reeds are indicated in Table 1 and Plate III. Plate I, the photograph of the reed designs used, indicates the relative dimensions of the experimental reeds. Reeds 1, 2, 3, 4, 6, and 7 were shaped by hand without the aid of a shaping-tool (see Glossary). The shaping of reeds without a tool resulted in playable reeds that were not consistent in shape. Extreme exaggerations resulted, and were used on the instruments to achieve a playable result. Table 1 indicates the reed dimensions and the stability (see Glossary) of each reed prepared.

The hand-shaped cane was attached to staples (see Glossary) altered to different lengths. Alterations were performed from the narrow and wide ends of the staple.

Scrape design

The "V" (see Glossary) scrape was used on most reeds, and varied from short to long in length. Length and thickness of the scrape affected the overblowing qualities of the 1807 oboe. The gouge (see Glossary), if too thick, affected overblowing. Gouging cane to a thickness of .10 millimeters thinner than present day dimensions allowed a shorter scrape in combination with a reed that was easier to blow. Shorter "V" scrapes proved to be the most stable in pitch, timbre, and overblowing characteristics. In Table 1, reeds 1, 3, 5, 6, 7, and 8 were prepared using a thinner gouge (see Glossary).

TABLE 1

Reed Scrape and Dimension Chart***

Reed	I	II	III	IV	V*	VI	VII	VIII**
Total length	5.3	6.25	6.2	6.05	6.95	5.8	4.78	5.65
Tube length	3.1	4.8	4.1	3.85	3.47	3.3	3.05	3.30
Wood length	2.2	1.45	2.1	2.10	3.48	2.5	1.70	2.35
Tip width	.85	.7	.75	.7	.75	.9	.85	.8
Throat width	.5x.6	.4x.5	.5x.5	.45	.5x.4	.4x.4	.5x.6	.45x.4
Scrape type	Short "V"	Long "V"	Short "V"	Long "W"	Stockholm	Short "V"	Short "V"	Double "V" MGG
Resistance	Medium	Medium	Medium	Medium	Hard	Medium Soft	Medium Soft	Medium Soft
Stability	Unstable	Unstable	Unstable	Good except low register	Excellent	Unstable	Unstable	Very Stable

*Satisfactory for use on 1916 oboe
**Satisfactory for use on 1807 oboe
***Dimensions in centimeters

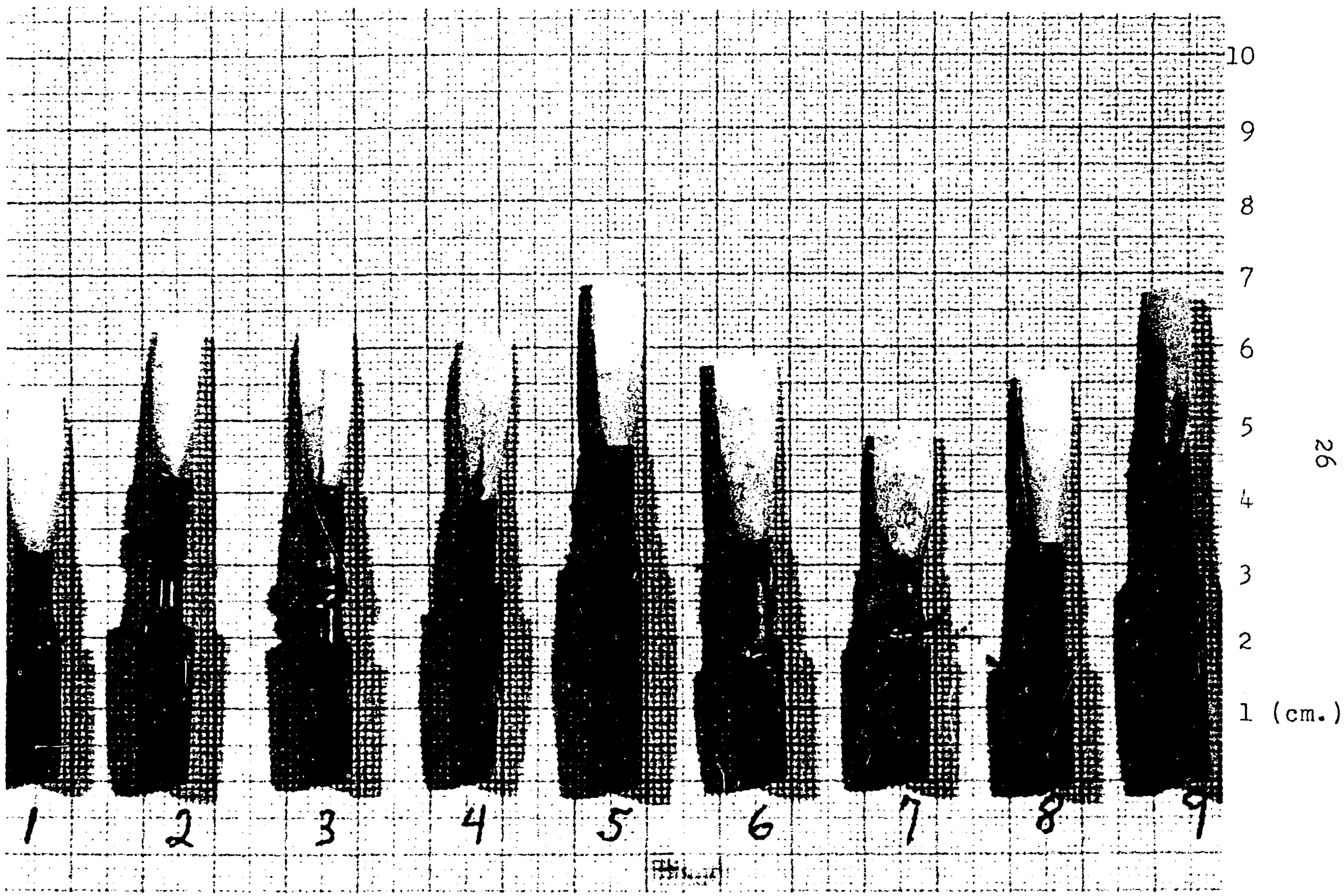

Table VII. Reeds prepared experimentally for use with the 1807 and 1916 oboes.

1916 oboe reeds

Reeds for the 1916 oboe required more attention to quality and timbre than to overblowing ability. The two octave keys on the instrument provided for consistent and accurate overblowing. The reed used on the 1916 oboe was similar in dimensions to the reed found to be stable on the 1807 oboe; however, the scrape design was entirely different. The scrape of the 1916 oboe reed was prepared from recollections of a personal visit with two oboists from the Stockholm Symphony Orchestra while on tour in the United States in 1970. The reed used by these oboists was resistant and created a dark timbre similar to that of other European oboists. The embouchure strength required to control the reed came from muscular support of the jaws, or a "biting" embouchure (see Glossary). The bark of the cane was scraped off of the entire reed surface, and a straight, thin tip of 1 mm length was then prepared. The resulting timbre from this reed style on the 1916 oboe was comparable to the European orchestral oboe sound previously mentioned. When played with the biting embouchure, stability and pitch of the instrument were accurate and consistent.

1968 oboe reed

The reed commonly used with the 1968 oboe was used experimentally in both the 1807 and 1916 oboes, but failed to produce satisfactory results. Overblowing was not possible and notes below g^1 would not respond. When used on the 1916 oboe, the results were not as undesirable, but did exhibit flat pitch in all registers and instability on notes above g^2. Reeds playable on the 1807 and 1916 oboes were found to be acceptable on the 1968 instrument owing to the evolution of bore and tone-hole refinements on the later instrument.

Reed and bore dimension comparison

As indicated in Table 2, the 1807 oboe possessed a consistently wider bore than the other two oboes. The reed length used on the 1807 oboe is shorter. The three instruments correspond to a greater degree at the R1, R2, and R3 tone holes.

The 1968 oboe, the most stable in the upper register, features bore dimensions at L1, L2, and L3 tone holes that are narrower than the other instruments. This would tend to lower the pitch of the instrument, were it not for the reed scrape design. The long "W" (see Glossary) scrape used in America, has more cane scraped out of the reed than the reeds used on the other two instruments. It is common knowledge among reed makers that removing cane from the reed (except for shortening the tip) will lower the pitch of the instrument. Narrowing the shape at the tip raises the pitch. Reeds for the 1807 and 1916 oboes used reed scrape designs leaving a considerable amount of cane in the reed which would raise the pitch of the reed were

TABLE 2

Reed and Bore Dimension Comparison*

	Reed		Staple									
	Length	Tip	Diameter	L1	L2	L3	R1	R2	R3	C	B	Bb
1807	5.65	.8	.5	.75	.85	.9	1.1	1.2	1.2	1.35		
1916	6.95	.75	.45	.70	.80	1.0	1.0	1.15	1.2	1.2	1.30	
1968	6.8	.75	.40	.68	.75	.85	1.05	1.10	1.2	1.31	1.41	1.65

*Dimensions in centimeters

it not overly compensated for by the wider tip dimension (1807 oboe) or longer length (1916 oboe). Both the 1807 and 1916 oboes have a wider upper-joint bore, a factor that would raise the overall pitch of the instrument and necessitate a reed with a lower pitch. The wider dimension at the tip would achieve this result.

V. INSTRUMENT PERFORMANCE CHARACTERISTICS

The determination of performance limitations and capabilities on the 1807 and 1916 oboes, compared with the 1968 instrument, constituted the last experimentation stage of the project. The first recordings demonstrate the instruments playing major scales. The scales were chosen to demonstrate the fingering problems and timbre characteristics as they appear in different scale patterns.

The 1807 oboe recorded scales beginning on c^1 and d^1. The c scale was chosen to demonstrate the production of the lowest note on the 1807 oboe as well as the most practical two-octave range of the instrument. The d scale provided awkward fingering problems affecting the smoothness and accuracy of scale execution.

The b and c scales were recorded on the 1916 oboe. Small b natural is the lowest note on the instrument and the b scale encompasses the largest practical range. The sharps in the key provided the opportunity to use the Triebert thumbplate action from a sharp to b natural in both octaves. The same action, with different fingerings, was also used from b natural to c in the c major scale. With practice, the Triebert thumbplate mechanism proved to be smooth and practical.

The 1968 oboe recorded the B flat and C scales. The scales presented no fingering problems comparable to the older instruments, but the scales were chosen to demonstrate the difference in timbre between this instrument and the 1807 and 1916 instruments.

Excerpts from the Karl Stamitz Oboe Concerto in Bb were then recorded on each instrument.[1]

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[1]Karl Stamitz, Oboe Concerto in Bb, ed. by J. Wojciechowski (Hamburg: N. Simrock), p. 4.

Figure 5. Stamitz' <u>Oboe Concerto</u>, First Movement, <u>Solo Oboe Part</u> (Excerpts played and recorded, Mm. 62-74; 99-115, indicated in brackets.)

Results of the first recording demonstrated the finger coordination problems of the 1807 and 1916 instruments confronting a performer not adequately familiar with the fingering systems involved. The use of the biting embouchure on the two reeds was necessary to insure the proper function of the reeds prepared for these instruments. The results were that the notes g^2-e^3 sounded sharp in relative pitch and strident in timbre. Diatonic passages were uneven rhythmically and contained "third" notes (see Glossary), due to cross fingerings on the 1807 instrument, and lack of familiarity with the Triebert mechanism on the 1916 oboe.

After approximately ten hours of practice on the 1807 oboe and three hours on the 1916 oboe, during which time breath support, embouchure formation, reed scrape, and finger control were adjusted to the peculiarities of the instrument, a second recording of the same passages was made. Most of the previously discussed problems of fingering, timbre, and intonation were eliminated, with the exception of inconsistent and inaccurate overblowing into the second octave on the 1807 oboe. However, the writer is reasonably sure that more practice time and reed making would eventually reduce the magnitude of such problems.

Octave speaker-keys on the 1916 instrument eliminated many performance problems that existed on the 1807 oboe. The use of a resistant reed with a darker timbre produced a timbre similar to the timbre experienced while listening to the Stockholm Orchestra oboist. Recording of the Stamitz Concerto resulted in uneven technique and inaccurate intonation. With approximately three hours of practice, the problems were not as apparent. The management of the Triebert mechanism improved with the practice. The use of a biting embouchure also improved the intonation throughout the range of the instrument.

The recordings of the 1968 oboe revealed a comparison of timbre rather than in technique, because familiarity with the key-system was greater on this instrument than was the case with the 1807 and 1916 oboes. The timbre of the

1968 instrument was decidedly mellower and not as strident as the other two. The differences were mainly accounted for in the reed design and embouchure formation. The freely vibrating reed and focused embouchure common in the United States produce a more "covered" sound with enough vibrancy to be heard through a mass of orchestral sound.

VI. CONCLUSIONS

The conclusions reached through examination of the results of the experiment indicate that instruments of the type of the 1807 and 1916 oboes were capable of expression, technical facility, and intonation and finger control that resulted in performance acceptable to the esthetic values of modern listeners.

The improvement of intonation, finger coordination, and dynamic control after a few hours of practice resulted in a decided amount of improvement in all aspects. An oboist in the 18th or 19th century, using these instruments professionally, would certainly have been able to manipulate reed style and embouchure to produce timbre and technique pleasing to the listener. If the slight changes in reed design and embouchure configuration used in the experiment contributed markedly to the improvement of esthetic qualities, then it is likely that the oboist contemporary with these instruments would have deliberately, or accidentally, discovered and utilized such alterations.

Conclusions about key mechanism and the chronological contributions that changed the key mechanism are not easily substantiated. It was found that the ability of the fingers and embouchure to adapt to a particular demand was extremely flexible, and the improvements in mechanism were designed to ease difficulties, and to make virtually impossible note combinations feasible with less effort. With practice, an acceptable technique was developed on both of the older instruments. The prominence of the French full-conservatory system at the present time is not due entirely to efficiency, but to a combination of tradition and the influences of such pioneering designers and performers on the oboe such as the Triebert family, A.M.R. Barret (1804-1879), and Georges Gillet (1854-1934).

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APPENDIX I

Instrument Specification Comparison Table

Subject Measured (cm.)	Instrument Year 1807	1916	1968
TOTAL LENGTH -------------	56.8	56.8	61.5
UPPER JOINT			
Non-Key Dimensions			
Bore Dia. (Upper) --------	.5	.45	.4
Bore Dia. (Lower) --------	.95	1.1	1.0
Bore Expansion Bulb Dia. -	3.4	----	----
Capital ------------------	3.2	----	----
Crown --------------------	2.55	2.6	2.55
Pediment Ring Dia. -------	3.25	----	2.4
Staple Depth -------------	2.2	1.9	1.9
Staple Socket Dia. -------	.5	.69	.7
Tenon Dia. ---------------	1.6	1.69	1.6
Tenon Length -------------	1.5	1.7	1.6
Upper Joint Length -------	23.5	25.0	28.0
Octave #2 Hole			
Bore ---------------------	----	.60	.49
Dist. --------------------	----	2.8	2.75
Hole Dia. ----------------	----	.06	.063
Octave #2 Key Mech.			
Axle Dia. ----------------	----	.35	.35
Axle Length --------------	----	6.6	6.3
Cup Arm Ext. -------------	----	----	1.0
Cup Arm Length -----------	----	.60	.4
Cup Dia. -----------------	----	.61	.7
Post (Upper) -------------	----	2.7	3.2
Post (Lower) -------------	----	12.1	10.8
Spring Dia. --------------	----	.006	.005
Spring Hook Length -------	----	2.05	2.3
Touchpiece Ext. ----------	----	1.45	.65
Touchpiece Length --------	----	3.2	4.0

Subject Measured (cm.)	Instrument Year 1807	1916	1968
<u>Octave #1 Hole</u>			
Bore ----------------------	----	.58	.5
Dist. --------------------	----	8.7	8.3
Hole Dia. ----------------	----	8.7	8.3
Outside Dia. -------------	----	1.9	2.3
<u>Octave #1 Touchpiece Mech.</u>			
Adjustment Arm Length ----	----	----	2.8
Axle Dia. ----------------	----	.35	.39
Axle Length --------------	----	3.31	3.7
Cup Arm Ext. -------------	----	----	----
Cup Arm Length -----------	----	.6	1.3
Cup Dia. -----------------	----	.61	.7
Post (Upper) -------------	----	8.39	7.5
Post (Middle) ------------	----	----	----
Post (Lower) -------------	----	11.96	11.1
Rod Dia. -----------------	----	.2	.25
Spring Dia. --------------	----	.09	.01
Spring Hook Length -------	----	2.4	1.95
Touchpiece Ext. ----------	----	1.09	1.7
Touchpiece Length --------	----	2.8	3.3
<u>Octave #1 Key Mech.</u>			
Axle Dia. ----------------	----	----	.03
Axle Length --------------	----	----	.79
Posts Length -------------	----	----	6.65
Rod Dia. -----------------	----	----	.02
Upper Post Length --------	----	----	6.65
<u>Octave #3 Hole</u>			
Bore ----------------------	----	----	.51
Dist. --------------------	----	----	9.15
Hole Dia. ----------------	----	----	.19
Outside Dia. -------------	----	----	2.31
<u>Octave #3 Key Mech.</u>			
Adjustment Arm Length ----	----	----	.9
Axle Dia. ----------------	----	----	.4
Axle Length --------------	----	----	2.0
Cup Dia. -----------------	----	----	.6
Cup Arm Ext. -------------	----	----	----
Cup Arm Length -----------	----	----	.9
Post (Upper) -------------	----	----	8.2
Post (Lower) -------------	----	----	10.65
Rod Dia. -----------------	----	----	.25
Spring Dia. --------------	----	----	.05
Spring Hook Length -------	----	----	2.0

Subject Measured (cm.)	Instrument Year 1807	1916	1968
<u>Octave #3 Key Mech. (cont.)</u>			
Touchpiece Ext. ----------	----	----	1.95
Touchpiece Length --------	----	----	2.2
<u>D Trill Hole</u>			
Bore --------------------	----	.65	.52
Dist. -------------------	----	11.6	11.5
Hole Dia. ----------------	----	.26	.29
Outside Dia. -------------	----	1.95	2.32
<u>D Trill Key Mech.</u>			
Adjustment Arm Length ----	----	----	----
Axle Dia. ----------------	----	.35	.34
Axle Length --------------	----	2.2	1.35
Cup Arm Angle ------------	----	----	4°
Cup Arm Ext. -------------	----	----	----
Cup Arm Length -----------	----	.5	.2
Cup Dia. -----------------	----	.9	.75
Lever Arm Length ---------	----	----	.71
Post (Upper) -------------	----	9.6	9.65
Post (Lower) -------------	----	12.15	12.40
Rod Dia. -----------------	----	----	.25
Spring Dia. --------------	----	.1	.05
Spring Hook Length -------	----	2.15	1.32
<u>C# Trill Hole</u>			
Bore --------------------	----	----	.63
Dist. -------------------	----	----	12.6
Hole Dia. ----------------	----	----	.25
Outside Dia. -------------	----	----	2.29
<u>C# Trill Key Mech.</u>			
Adjustment Arm Length ----	----	----	----
Axle Dia. ----------------	----	----	.34
Axle Length --------------	----	----	1.1
Cup Arm Angle ------------	----	----	4°
Cup Arm Ext. -------------	----	----	----
Cup Arm Length -----------	----	----	.45
Cup Dia. -----------------	----	----	.75
Post (Upper) -------------	----	----	9.65
Post (Lower) -------------	----	----	12.40
Rod Dia. -----------------	----	----	.25
Spring Dia. --------------	----	----	.05
Spring Hook Length -------	----	----	1.6
<u>D & C Trill Touchpiece Mech.</u>			
Adjustment Arm Length ----	----	----	----
Axle Dia. ----------------	----	----	.5

Subject Measured (cm.)	Instrument Year 1807	1916	1968
D & C# Trill Touchpiece Mech. (cont.)			
Axle Length	----	----	12.1
Lever Arm Length	----	----	.95
Post (Upper)	----	----	10.35
Post (Lower)	----	----	22.4
Rod Dia.	----	----	----
Touchpiece Arm Length	----	----	1.55
Touchpiece Length	----	----	1.1
C# to D Axle			
Bridge Lever Ext.	----	----	.5
Bridge Lever Length	----	----	.85
Connection Arm Length	----	----	2.89
Triebert Thumb-Plate Mech.			
Dist. to Pivot Lever	----	.35	----
Pivot Lever Dia.	----	.35	----
Pivot Lever Length	----	2.25	----
Post (Upper)	----	14.1	----
Post (Lower)	----	16.1	----
Thumb Axle Dia.	----	.3	----
Thumb Axle Length	----	2.0	----
Thumb Rod Dia.	----	.2	----
Touchpiece Dist.	----	15.3	----
Triebert Mech. Rl Side Key			
Axle Dia.	----	.3	----
Axle Length	----	5.4	----
Bb Cup Arm Length	----	.55	----
Bb Cup Dia.	----	.9	----
C Cup Arm Length	----	.55	----
C Cup Dia.	----	.9	----
Post (Upper)	----	14.7	----
Post (Middle)	----	11.0	----
Post (Lower)	----	21.9	----
Rod Dia.	----	.2	----
Touchpiece Ext.	----	1.0	----
Touchpiece Length	----	3.7	----
Ll Hole			
Bore	.75	.70	.68
Dist.	13.6	13.4	13.4
Hole Dia.	.3x.25	.25	.29
Outside Dia.	1.85	1.96	2.3
Vent Hole Dia.	----	.1x.25	.25x.1

Subject Measured (cm.)	Instrument Year 1807	1916	1968
L1 Key Mech.			
Adjustment Arm Length ----	----	----	.25
Axle Dia. ----------------	----	.25	.27
Axle Length --------------	----	----	1.6
Cup Arm Ext. -------------	----	----	----
Cup Arm Length -----------	----	.55	.8
Cup Dia. -----------------	----	.95	1.1
Post (Upper) -------------	----	12.1	11.9
Post (Lower) -------------	----	20.9	13.9
Rod Dia. -----------------	----	----	.25
Spatula Length -----------	----	----	.7
Spring Hook Length -------	----	----	1.45
Spring Hook Dia. ---------	----	----	.05
Touchpiece Length --------	----	----	----
C Key Hole			
Bore ---------------------	----	.75	.73
Dist. --------------------	----	15.3	15.1
Hole Dia. ----------------	----	.25	.30
Outside Dia. -------------	----	2.05	2.37
Vent Hole Dia. -----------	----	----	----
C Key Mech.			
Axle Dia. ----------------	----	.3	.37
Axle Length --------------	----	----	1.3
Bb Adjustment Screw Length ----------------	----	----	2.9
C Adjustment Screw Length ----------------	----	----	1.55
Cup Arm Ext. -------------	----	----	----
Cup Arm Length -----------	----	.55	.95
Cup Dia. -----------------	----	.9	.71
Post (Upper) -------------	----	14.7	13.9
Post (Lower) -------------	----	17.0	----
Rod Dia. -----------------	----	.2	----
Spatula Length -----------	1.35	1.39	----
Spring Dia. --------------	----	.05	.04
Spring Hook Length -------	----	1.75	1.19
Touchpiece Length --------	----	----	----
L2 Hole			
Bore ---------------------	.85	.80	.75
Dist. --------------------	16.7	16.6	16.6
Hole Dia. ----------------	.3x.25	3.9	.40
Outside Dia. -------------	1.95	2.1	2.40
Vent Hole Dia. -----------	----	----	.03

Subject Measured (cm.)	1807	Instrument Year 1916	1968
L2 Key Mech.			
Axle Dia.	----	.3	.37
Axle Length	----	----	1.5
Rod Dia.	----	.2	.25
Spatula Length	----	----	----
Touchpiece Length	----	----	----
Ab-Bb Trill Mech.			
Adjustment Arm Length	----	----	.6
Bridge Lever Length	----	1.0	----
Post (Upper)	----	----	----
Post (Lower)	----	17.0	17.0
Spring Dia.	----	.05	.03
Spring Hook Length	----	1.75	.4
Trill Arm Length	----	----	.3
Bb Hole			
Bore	----	.81	.79
Dist.	----	18.3	18.3
Hole Dia.	----	.27	.35
Outside Dia.	----	2.11	2.41
Vent Hole Dia.	----	----	----
Bb Key Mech.			
Axle Dia.	----	.3	.39
Axle Length	----	----	1.0
Bb Adjustment Arm Ext.	----	----	----
Bb Adjustment Arm Length	----	----	1.6
Cup Arm Ext.	----	----	----
Cup Arm Length	----	.7	1.02
Cup Dia.	----	.9	----
L3 Adjustment Arm Ext.	----	----	.75
L3 Adjustment Arm Length	----	----	.75
Post (Upper)	----	17.0	----
Post (Lower)	----	21.9	----
Rod Dia.	----	.2	.25
Spring Dia.	----	.05	.5
Spring Hook Length	----	1.75	1.0
B & C Bridge Axle			
Axle Dia.	----	----	.39
Axle Length	----	----	.9
Lever Arm Length	----	----	1.2
Spring Dia.	----	----	.07
Spring Hook Length	----	----	.15

Subject Measured (cm.)	Instrument Year 1807	1916	1968
L3 Hole			
A Hole Angle	15°R	----	----
Bore	A-.9 G#-.9	1.0	.85
Dist.	A-19.0		
	G#-20.0	19.75	19.9
G# Hole Angle	15°R	----	----
Hole Dia.	A-.25x.23		
	G#-.2x.24	.39	.37
Outside Dia.	A-1.9		
	G#-1.9	2.1	2.47
Vent Hole Dia.	----	----	.3
L3 Key Mech.			
Axle Dia.	----	.35	----
Axle Length	----	6.1	1.9
Bb Adjustment Arm Length	----	----	.8
Cup Arm Length	----	.55	.9
Cup Dia.	----	----	1.05
Post (Upper)	----	12.1	17.0
Post (Lower)	----	20.9	21.4
Ring (Inside)	----	.9	----
Ring (Outside)	----	1.15	----
Rod Dia.	----	.25	----
Saddle Dist.	----	----	19.4
Spring Dia.	----	.05	.05
Spring Hook Length	----	1.9	.9
B & C Bridge Key Mech.			
Axle Dia.	----	----	.3
Axle Length	----	----	1.2
Flat Spring Dist. from	----	----	
Bridge	----	----	5.0
Flat Spring Length	----	----	2.65
Post(Upper)	----	----	20.6
Post (Lower)	----	----	20.6
Rod Dia.	----	----	.2
G#-A Trill Touchpiece Mech.			
Axle Dia.	----	----	.3
Axle Length	----	----	.8
Rod Dia.	----	----	.2
Touchpiece Arm Ext.	----	----	1.3

Subject Measured (cm.)	Instrument Year 1807	1916	1968
Left G# Key Mech.			
Ab-Ab Trill Arm Lever Length	----	.9	.9
Axle Dia.	----	----	.3
Axle Length	----	1.7	.85
Cup Arm Length	----	.4	1.1
Cup Dia.	----	.9	.75
Post (Upper)	----	20.9	21.1
Post (Lower)	----	22.9	22.4
Rod Dia.	----	----	.2
Spring Dia.	----	.09	----
Spring Length	----	1.65	----
Touchpiece Ext.	----	2.15	----
Touchpiece Length	----	2.15	2.85
Left Ab-Bb Trill Mech.			
Axle Dia.	----	5.3	----
Axle Length	----	.4	----
G# Lever Length	----	.8	----
L2 Arm Length	----	1.65	----
Post (Upper)	----	17.2	----
Post (Lower)	----	22.6	----
Rod Dia.	----	.3	----
Right G# Mech.			
Cup Dia.	----	----	.75
Cup Arm Length	----	----	1.1
Left G# Lever Arm Length	----	----	1.1
Post (Upper)	----	----	21.4
Post (Lower)	----	----	23.0
Spring Dia.	----	----	.04
Spring Hook Length	----	----	.25
Triebert Articulation Arm Length	----	----	1.1
G# Hole			
Bore	.9	1.1	.95
Dist.	20.0	22.6	22.8
Hole Dia.	.2x.24	.32	.45
Outside Dia.	1.9	2.15	2.49

Subject Measured (cm.)	Instrument Year 1807	1916	1968
LOWER JOINT			
Non-Key Dimensions			
Bore Dia. (Upper)	1.0	1.1	1.0
Bore Dia. (Lower)	1.4	1.73	1.7
C Key Cover Saddle-Ring	3.3	----	----
D# & C Key Saddle-Ring Dia.	3.1	----	----
Lower Joint Length	25.0	25.5	26.0
Lower Ornamental Base Ring Dia.	2.95	----	----
Lower Tenon Dia.	2.17	2.25	2.15
Lower Tenon Length	2.65	1.55	1.55
Upper Ornamental Base Ring Dia.	2.9	----	----
Upper Socket Depth	1.6	1.7	1.7
Upper Socket Dia.	1.6	1.7	1.5
Upper Socket Expansion	3.6	----	----
Rl Hole			
Bore	1.1	1.0	1.05
Dist.	4.6	2.4	2.3
Hole Dia.	.51x.5	.4	.5
Outside Dia.	2.1	2.3	2.55
Rl Key Mech.			
Axle Dia.	----	----	.38
Axle Length	----	----	2.1
Bridge Key Arm Ext.	----	----	1.15
Bridge Key Arm Length	----	----	1.25
F#-G# Trill Arm Ext.	----	----	.4
F#-G# Trill Arm Length	----	----	.7
Post (Upper)	----	----	.25
Post (Lower)	----	----	2.7
Rod Dia.	----	----	.23
Spring Dia.	----	----	.07
Spring Hook Length	----	----	.07
F# Hole			
Bore	----	1.05	1.07
Dist.	----	4.1	3.9
Hole Dia.	----	.3	.35
Outside Dia.	----	2.35	2.57

Subject Measured (cm.)	1807	Instrument Year 1916	1968
F# Key Mech.			
Axle Dia.	----	.35	.38
Axle Length	----	----	2.5
Cup Arm Length	----	.75	.95
Cup Dia.	----	.9	.75
Forked F Adjustment Arm Length	----	----	.31
Post (Upper)	----	3.9	.25
Post (Lower)	----	10.7	17.1
R2 Adjustment Arm Ext.	----	----	.55
R2 Adjustment Arm Length	----	1.1	.5
Spring Dia.	----	----	.08
Spring Hook Length	----	2.3	2.5
R2 Hole			
Bore	1.2	1.15	1.1
Dist.	8.1	5.75	5.59
Hole Dia.	.5	.45	.49
Outside Dia.	2.2	2.35	2.6
R2 Key Mech.			
Axle Dia.	----	.35	.3
Axle Length	----	6.9	----
Cup Arm Length	----	.75	1.0
Cup Dia.	----	----	1.1
F# Adjustment Arm Length	----	----	.65
Post (Upper)	----	----	5.2
Post (Lower)	----	----	----
R2 Ring Key Dia. (Inside)	----	.89	----
R2 Ring Key Dia. (Outside)	----	1.15	----
Rod Dia.	----	----	----
Spring Dia.	----	----	.06
Spring Hook Length	----	----	5.05
Right Main Axle Mech.			
C Key Bridge Lever Arm Length	----	----	1.25
C Key Lever Arm Ext.	----	----	.5
C Key Lever Arm Length	----	----	.9
Forked F Lever Arm	----	----	1.0

Subject Measured (cm.)	Instrument Year 1807	1916	1968
Chromatic F Hole			
Bore	----	1.1	1.07
Dist.	----	7.3	6.95
Hole Dia.	----	.5	.49
Outside Dia.	----	2.37	2.57
Chromatic F Key Mech.			
Axle Dia.	----	.35	.49
Axle Length	----	----	1.45
Cup Arm	----	----	.95
Cup Dia.	----	----	.95
Rod Dia.	----	.2	.25
Touchpiece Length	----	1.9	1.63
Left Chromatic F Mech.			
Lever Length	----	----	.7
Post (Upper)	----	----	6.4
Post (Lower)	----	----	8.3
Spring Dia.	----	.9	.05
Spring Hook Length	----	1.3	1.45
R3 Hole			
Bore	1.2	1.2	1.2
Dist.	11.5	8.75	6.1
Hole Dia.	.45x.5	.49	.53
Outside Dia.	2.3	2.45	2.7
R3 Ring Key Mech.			
F# Adjustment Arm Ext.	----	----	.55
F# Adjustment Arm Length	----	----	.85
Forked F Adjustment Arm Length	----	----	.9
Ring Arm Length	----	.75	1.0
Ring Dia. (Inside)	----	.85	.85
Ring Dia. (Outside)	----	1.1	1.4
R3 Key Cup Mech.			
Axle Dia.	----	----	.39
Axle Length	----	----	1.05
Cup Arm Length	----	----	1.2
Cup Dia.	----	----	1.2
Eb-E Trill Lever Arm Length	----	----	.35
Spring Dia.	----	----	.07
Spring Hook Length	----	----	.9
Vent Opening Dia.	----	----	.55

Subject Measured (cm.)	Instrument Year 1807	1916	1968
<u>F Resonance Key Mech.</u>			
Axle Dia.	----	----	.3
Axle Length	----	----	.65
Cup Arm Length	----	----	.95
Cup Dia.	----	----	.95
Post (Upper)	----	----	11.2
Post (Lower)	----	----	11.2
Resonance Key Adjustment Arm Length	----	----	1.15
Ring Key Adjustment Arm Length	----	----	1.15
Rod Dia.	----	----	.2
<u>F Resonance Key Rocker Arm</u>			
Axle Dia.	----	----	.31
Axle Length	----	----	.6
Post (Upper)	----	----	8.6
Post (Lower)	----	----	8.6
Rocker Arm Length	----	----	1.85
Rod Dia.	----	----	.2
<u>F Resonance Hole</u>			
Bore	----	----	1.08
Dist.	----	----	12.7
Hole Dia.	----	----	.49
Outside Dia.	----	----	2.58
<u>Eb Hole</u>			
Bore	----	1.19	1.3
Dist.	15.7	12.8	12.5
Hole Dia.	.6x.61	.55	.6
Outside Dia.	----	2.49	2.8
Pad Seat Dia.	.95x1.55	12.8	12.5
<u>Eb-Db Key Mech.</u>			
Axle Dia.	----	.35	.39
Axle Dist. to Cup	1.7	----	----
Axle Dist. to Touchpiece	2.15	----	----
Axle Length	----	1.0	----
Db Key Arm Length	----	2.6	.75
Db Key Touchpiece Angle	----	----	10°
Db Key Touchpiece Length	----	1.4	.75
Eb Key Arm Length	----	3.0	3.25
Eb Key Slot Depth	.4	----	----
Eb Key Slot Length	1.1	----	----

Subject Measured (cm.)	Instrument Year 1807	1916	1968
Eb-Db Key Mech. (cont.)			
Eb Key Slot Width --------	.32	----	----
Eb Touchpiece Angle ------	----	----	15°
Eb Touchpiece Length -----	----	----	3.25
Post (Upper) -------------	----	19.5	10.8
Post (Lower) -------------	----	23.2	18.9
Rod Dia. -----------------	----	.2	----
Saddle Dia. --------------	3.1	----	----
Saddle Width -------------	1.1	----	----
Spring Dia. --------------	----	.07	.05
Spring Hook Length -------	----	3.85	7.2
Eb Key Cup Mech.			
Axle Dia. ----------------	----	.3	----
Axle Length --------------	----	1.4	----
C Adjustment Screw Ext. --	----	3.1	1.3
Cup Arm Length -----------	----	----	1.22
Cup Dia. -----------------	----	1.1	1.05
Post Dist. ---------------	----	19.5	14.8
Rod Dia. -----------------	----	.2	----
Spring Dia. --------------	----	.05	----
Spring Hook Length -------	----	3.85	----
C# Hole			
Bore ---------------------	----	1.25	1.4
Dist. --------------------	----	19.2	19.5
Hole Dia. ----------------	----	.55	1.55
Outside Dia. -------------	----	2.55	2.9
C# Key Mech.			
Adjustment Screw Length --	----	----	1.36
Axle Dia. ----------------	----	----	.31
Axle Length --------------	----	----	.76
Cup Arm Length -----------	----	5.5	1.19
Cup Dia. -----------------	----	1.1	1.12
Lever Arm Length ---------	----	----	.34
Post (Upper) -------------	----	----	21.2
Post (Lower) -------------	----	----	21.2
Spring Dia. --------------	----	----	----
Spring Hook Length -------	----	----	----
Touchpiece Arm Angle -----	----	----	10°
Touchpiece Arm Length ----	----	2.6	.75
Touchpiece Length --------	----	1.4	.75

Subject Measured (cm.)	Instrument Year 1807	1916	1968
C Hole			
Bore	1.35	1.20	1.31
Dist.	19.0	15.7	15.9
Hole Dia.	.7x.69	.79	.8
Outside Dia.	2.45	2.5	2.81
Pad Seat Dia.	1.05x1.25	----	----
C Key Mech.			
Alternate C Key Lever-Arm Length	----	----	1.0
Axle Dia.	----	3.5	.35
Axle Length	----	4.0	6.4
Axle to Hinge	.8	----	----
Bb-B Stop Adjustment Arm Ext.	----	----	.45
Bb-B Stop Adjustment Arm Length	----	----	1.59
C# Trill Adjustment Arm Length	----	----	1.1
Cup Arm Length	1.75	1.0	1.25
Cup Dia.	----	1.25	1.25
Post (Upper)	----	10.5	10.6
Post (Lower)	----	16.3	17.4
Spring Dia.	----	.08	.01
Spring Hook Length	----	1.7	2.55
Touchpiece Angle	----	20°	15°
Touchpiece Arm Length	2.75	1.2	----
Touchpiece Length	2.5	2.65	3.2
Eb-B-Bb Key Mech.			
Axle Dia.	----	.35	.39
Axle Length	----	15.9	----
Eb Touchpiece Angle	----	----	35°
Bb Touchpiece Ext.	----	----	1.2
Bb Touchpiece Length	----	----	1.7
B-Bb Connection Arm Length	----	----	.9
B Lever Arm Length	----	----	.95
B Touchpiece Angle	----	35°	35°
B Touchpiece Ext.	----	2.2	----
B Touchpiece Length	----	2.2	1.65
Eb-B-Bb Bridge Key Arm Ext.	----	----	.41
Eb-B-Bb Bridge Key Arm Length	----	----	2.9

Subject Measured (cm.)	Instrument Year 1807	1916	1968
Eb-B-Bb Key Mech. (cont.)			
Eb-E Trill Lever Arm Length	----	----	2.0
Eb Lever Arm Length	----	.9	3.1
Eb Touchpiece Angle	----	35^{o}	35^{o}
Eb Touchpiece Ext.	----	----	.5
Eb Touchpiece Length	----	----	1.2
Middle Saddle Axle Dia.	----	----	.3
Middle Saddle Axle Length	----	----	.4
Middle Saddle Post	----	8.0	13.7
Post (Upper)	----	.4	.29
Post (Lower)	----	17.25	----
B Hole			
Bore	----	1.3	----
Dist.	----	22.7	----
Hole Dia.	----	.8	----
Outside Dia.	----	2.6	----
B Key Mech.			
Axle Dia.	----	----	.3
Axle Length	----	----	6.5
Cup Arm Length	----	----	1.25
Cup Dia.	----	----	1.25
Lever Arm Length	----	----	1.3
Post (Upper)	----	----	14.6
Post (Lower)	----	----	23.3
Spring Dia.	----	----	----
Spring Hook Length	----	----	4.05
Bb Bridge Key Mech.			
Arm Ext. (Upper)	----	----	.9
Arm Ext. (Lower)	----	----	.45
Arm Length (Upper)	----	----	.9
Arm Length (Lower)	----	----	1.23
Axle Dia.	----	----	3.5
Axle Length	----	----	4.6
Post (Upper)	----	----	18.4
Post (Lower)	----	----	23.3
Spring Hook Length	----	----	2.45

Subject Measured (cm.)	Instrument Year 1807	1916	1968
Trill Key Bridge Mech.			
Axle Length	----	----	4.31
Bridge Arm Ext.	----	----	1.55
Bridge Arm Length	----	----	1.25
Post (Upper)	----	----	4.65
Post (Lower)	----	----	.1
Spring Hook Dia.	----	----	.04
Spring Hook Length	----	----	2.11
Touchpiece Length	----	----	2.5
Left F Key			
Axle Dia.	----	----	.3
Axle Length	----	----	1.3
Post (Upper)	----	----	3.9
Post (Lower)	----	----	3.9
Saddle Dist.	----	----	6.1
Touchpiece Height	----	----	1.5
Touchpiece Length	----	----	3.4
Left F Key Lever Arm Mech.			
Axle Dia.	----	----	.31
Axle Length	----	----	.83
Chromatic F Lever Arm Length	----	----	1.9
Left F Lever Arm Length	----	----	3.3
Post (Upper)	----	----	4.01
Post (Lower)	----	----	4.01
Spring Dia.	----	----	.02
Spring Hook Length	----	----	1.81
BELL JOINT			
Non-Key Dimensions			
Bell Flare Dia.	6.5	5.4	4.9
Bell Flare Width	----	1.35	1.31
Bell Lip Depth	.45	----	----
Bell Lip Width	1.2	----	----
Bore (Upper)	1.95	1.85	1.7
Bore (Lower)	4.45	3.9	3.75
Ring Dia. (Upper)	----	2.8	3.1
Ring Dia. (Lower)	----	5.6	5.2
Socket Depth	2.6	1.6	1.61
Socket Dia.	2.15	2.2	2.13
Total Length	14.4	9.4	----
Upper Socket Expansion Dia.	3.6	----	----

Subject Measured (cm.)	Instrument Year 1807	1916	1968
Bell Holes			
Bore	----	----	1.6
Dia. (Left)	.55	----	----
Dia. (Right)	.55	----	1.0
Dist. (Left)	4.95	----	----
Dist. (Right)	4.95	----	2.50
Outside Dia.	----	----	3.1
Bb Key Mech.			
Axle Dia.	----	----	.35
Axle Length	----	----	2.49
Bridge Key Arm Length	----	----	.8
Bridge Key Length	----	----	1.0
Cup Arm Length	----	----	1.3
Cup Dia.	----	----	1.3
Post (Upper)	----	----	.01
Post (Lower)	----	----	3.0
Ring Anchor Plate	----	----	2.01

GLOSSARY

Axle.

The hollow metal tube to which the key-cup arms and touchpiece are attached. The axle may pivot with a stationary rod extending a fraction of, or the entire, length through the hollowed portion. Some axles are attached to posts only by pivot screws holding them to the posts and allowing free rotation. The axle may have more than one key or touchpiece attached.

The rod-axle system was made famous by Theobald Boehm in 1832, when he applied this invention to the flute and later to the oboe.

Bark.

The hard, shiny outside layer of reed cane. Thickness and hardness vary with the quality and type of cane.

Bore, bore-diameter.

The inside diameter of the instrument. In the case of the conically shaped oboe, its dimensions vary along the length of the instrument. The proportions of the diameter to the length of the oboe, and the diameter of the tone hole affect pitch, timbre, and stability.

Cane.

The bamboo-like (Arundo donax) wood from which the reed is prepared. The cylindrical tube must be of a certain diameter (.10-.105 cm.) to be suitable for oboe reeds. The most common source of cane is France, where weather and soil composition exert a favorable influence on the quality of cane. Good cane contains many fibres that are hard in texture and arranged close together.

Cup.

The round device in which the tone-hole pad is seated. These may be operated directly by the fingers, as on keys L1, L2, L3, R1, R2, and R3, or by levers on other keys.

Distance, hole distance.

The distance from the center of the tone or speaker-hole to the upper end of the joint in which it is located.

Embouchure, biting.

The formation of the lips around the oboe reed to control its volume, pitch, and timbre. A biting embouchure utilizes vertical jaw pressure to close the reed and control the vibrations. This embouchure is frequently employed with the short V scrape used in Britain and Europe.

Embouchure, focused.

A focused embouchure uses lip pressure and jaw pressure. The lip pressure is exerted laterally, while the vertical jaw pressure is kept to a minimum. This prevents the closing of the softer long-W scrape with which it is used and results in an open, rather than pinched timbre. It is employed mostly by oboists in the United States.

Fingering designations.

Abbreviations of the fingers and the holes to which they belong are referred to in this paper. L1, L2, and L3 refer to the index, second, and third fingers of the left hand and the tone holes on which they are placed. R1, R2, and R3 indicate the same fingers on the right hand. The left hand operates keys on the upper joint, the right hand operates keys on the lower joint.

The little fingers of each hand operate several keys. The little finger of the left hand operates keys functioning both in the upper and lower joint of the instrument. The right-hand little finger operates only keys in the lower joint.

Forked fingerings; cross fingerings.

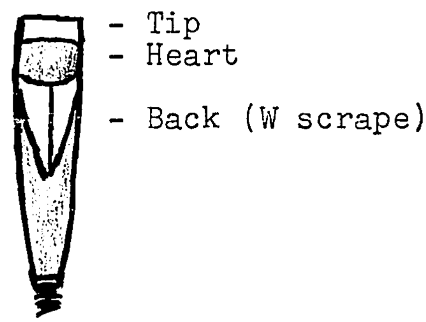
Fingerings on woodwind instruments that are not obtained by sequentially lifting or depressing fingers as they occur on the instrument. A forked fingering may be represented by R1 and R3 depressed together, with R2 raised. The alternation between this fingering and one such as R1 and R2 will result in "3rd" notes if the raising and depressing of the fingers is not exactly co-ordinated. Other combinations similar to the one described above occur on the oboe. It is for the elimination of forked fingerings that many key systems were added to the older instruments such as the 1807 oboe. The Triebert mechanism on the 1916 oboe is such an example, eliminating the forked b flat in the left hand, fingered L1 and L3.

Gouge.

The gouge is the thickness of the inside diameter of the cane before it is shaped and tied on the staple. Tube cane is split lengthwise into three equal parts, whose sections are placed in a gouging machine that planes the inside diameter of the sections to the proper thickness. The thicker the gouge, the more wood the oboist will need to scrape from the reed design to allow the proper vibration. The gouge dimensions used in the United States approximate .60 mm. thick at the center of the cane section and taper to .45 mm. on the sides. The gouge will vary according to the instrument, staple dimensions, player's embouchure, cane hardness, and shape design.

Heart.

The area of cane immediately behind the tip of the reed that is deliberately calculated to be thicker than the tip. Its dimensions are approximately as great as the tip length. The way in which the heart is scraped in relation to the length and thickness of the tip influences pitch, timbre, and stability. The heart area of a reed is associated with the long "W" scrape design. The thickness of the heart balances the amount of cane scraped from the "W" section.



(Dark areas indicate the presence of more cane)

Octave keys, speaker keys.

The uppermost keys on the upper joint that, when opened, facilitate overblowing the octave. On current oboes, octave key #1 is used from e^2-$g\#^2$. Octave #2 is used on a^2-c^3.

Outside diameter, outside dia.

The diameter of the instrument at the entrance of a particular tone of speaker hole.

Post.

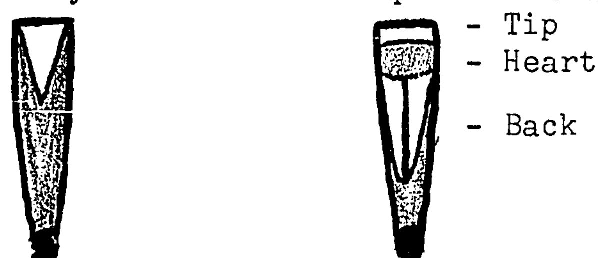
The anchor points on which the extreme ends of the axle pivots. The posts are threaded into the outside wall of the instrument.

Post distance.
The distance from the post to the upper end of the joint.

Reed strength.
The resistance of the reed to vibration by the player's air stream. Resistance may be affected by the opening of the reed, the thickness of the tip, or the amount of wood left in the scrape design by the reed-maker.

Reed opening.
The distance between the two inside edges of the tip of the reed. A large opening will produce a vibration with more amplitude and thus a louder dynamic level. Such reeds require a biting embouchure to control the amplitude of the reed for soft musical passages and passages demanding a blending timbre.

Scrape style.
The manner in which the cane is pared from the surface of the reed to allow the reed to vibrate. The style of scrape may vary from the V scrape to the W scrape.



V scrape. W scrape.

Shape.
The profile of the reed as it is observed from an angle of 90° to its flat side. The taper dimensions of the shape influence pitch, reed response, and timbre. Varying shapes are used by oboists to compensate for instrument, cane, and embouchure characteristics.

Shaping tool.
The hard metal profile on which a piece of cane is placed and scraped to the proper shape dimensions.

Spatula.
A small touchpiece attached directly to the key cup to facilitate finger placement or co-ordination.

Springs.

The flat or round tempered steel devices that, when displaced by the finger action on the keys, return the keys to their original position, either open or closed. The springs of woodwind instruments are of two types, flat and round.

The flat steel spring is located under the arm of the key and in between the posts on which the key axle pivots. They are attached so as to exert an upward pressure to either open or close the key.

Spring-hook length.

The distance from the upper end of the axle to the catch (hook) against which the springs push to respond to key movement.

Stability.

The subjective factor used in evaluation of the reed, the instruments, and their combined ability to consistently overblow, maintain good relative intonation, and respond to wide changes in dynamics and timbre.

Staple, tube.

The hollow, conical shaped brass tube to which the gouged shaped and folded reed cane is attached with string winding. The small aperture is oval in shape, and widens to a cylindrical shape at the large aperture. The lower section is wrapped with cork on the outside to insure an airtight seal when inserted into the staple socket of the oboe.

Staple socket.

The female aperture into which the reed staple is inserted into the upper joint of the oboe. Its depth affects the overall pitch and stability of the instrument. The reed may be in or out of the socket at varying lengths to adjust the pitch of the instrument.

Tenon joint.

The device by which the upper, lower, and bell joints are attached to each other. Tenon joints are of two sections, the male (tenon) and the female (tenon socket). The diameter of the tenon is covered with cork or string to insure an airtight fit when it is placed into the tenon socket.

Third notes.

Unwritten, extra notes appearing between conjunct or disjunct notes in a musical passage. The notes result from improper finger co-ordination. (see Fingerings).

Throat.

The outside diameter of the reed where the wrapping string ends and the shaped cane becomes visible. The throat dimension is determined by the diameter of the oval shaped, small aperture of the staple.

Tip.

The thinly scraped area of the reed where the vibration is initiated with the breath stream. The tip may be straight or curved. Relation of tip length to tip thickness and the amount of wood removed from the back and the length of the back is direct. Longer tips require a slightly thicker scrape and a shorter, firmer back area. The tips may vary in length from .35 cm. to .05 cm.

Straight tip.

Curved tip.

Tone-hole diameter, hole dia.

The inside diameter of the tone-hole as it exists at the entrance of the instrument.

Touchpiece.

The plate on the key mechanism that the finger contacts to activate the mechanism. All keys operated by the right and left little fingers have touchplates. In addition, the octave keys, trill keys, and the chromatic f key are activated by touchpieces.

The touchpiece angle is determined by its accessibility to the fingers required to operate it.

The touchpiece extension is the distance that it protrudes from the midpoint of the axle.

The touchpiece arm is the connection between the touchpiece and the axle.

VITA

David Leroy Busch was born on October 11, 1943, in Burke, South Dakota. His elementary education was completed in public schools in Wolsey, Brookings, and Vermillion, South Dakota. After graduation from Vermillion High School, he entered the Municipal University of Omaha, Omaha, Nebraska, and graduated in 1965 with a Bachelor of Fine Arts in Oboe with additional public secondary school teaching credentials.

In 1965 he successfully gained a position in the United States Navy Band, Washington, D.C., and during his tour of duty he attended Catholic University of America in Washington, D.C., where he graduated in 1969 with a Master of Music in Oboe.

The following year was spent in professional performing activities with the National Ballet and the Washington Opera Society in addition to private teaching in the Washington area.

After entering Louisiana State University, Baton Rouge, Louisiana, in 1969, in pursuance of the degree of Doctor of Musical Arts in Oboe, the author subsequently accepted a position as Instructor of Oboe at West Virginia University, Morgantown, West Virginia, where he currently resides with his wife and daughter.

Other professional activities involve participation in the Premiere production of Leonard Bernstein's "Mass" at the opening of the John F. Kennedy Center in Washington, D.C., and as solo English Horn with the Wolf Trap Farm Park for the Performing Arts in Vienna, Virginia.

EXAMINATION AND THESIS REPORT

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Major Field: Music

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Approved:

Earnest Harrison - Everett Timm

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